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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/706,205	11/13/2003	Bor Z. Jang		6004

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Nanotek Instruments Inc
9436 Parkside Dr
Centerville, OH 45458

EXAMINER
ALEJANDRO, RAYMOND

ART UNIT	PAPER NUMBER
1745	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/21/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

C

Office Action Summary	Application No.	Applicant(s)	
	10/706,205	JANG ET AL.	
	Examiner	Art Unit	
	Raymond Alejandro	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 December 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19,39-43,46 and 47* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-19,39-43,46 and 47* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *13 November 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *11/13/03*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election of Group I (claims 1-19, 39-43 and 46-47) in the reply filed on 12/26/06 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)). *To the extent that applicant could have traversed the restriction requirement, please note that the Examiner has accepted applicant's proposed claim grouping and/or amendment as well as the explanation as to why a close relationship exists among the elected group, species and/or claims for purposes of immediate examination under one inventive group.*

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on 11/13/06 was considered by the examiner.

Drawings

3. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: 56, 58 and 99b. Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet

submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

4. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: 93. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

5. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference character "66" has been used to designate both "the arc" and "the arc zone". Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and

informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

6. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited *to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited*. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

Claim Rejections - 35 USC § 112

7. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

8. Claims 1-19, 39-43 and 46-47 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

9. The language "*eventual* anode side" or "*eventual* cathode side" in claims 1, 3, 19 and 39 is indefinite as the term "*eventual*" appears to encompass a non-tangible, non-concrete or non-material article. It is unclear from the present claim language whether an anode side or cathode side is ultimately intended as part of the claimed invention. Thus, it amounts to a gap between the necessary structural connections and/or steps by omitting necessary steps and/or structural

cooperative relationship helpful to ascertain the scope of the present invention. As best understood, it seems that applicant is intending to claim a feature that does not exist at the time of implementing the specific steps of claims 1, 3 and 39.

10. Claims 19 and 41 recite the limitation "a first catalyst" and "a second catalyst" in lines 1 and 2 There is insufficient antecedent basis for this limitation in the claim. It is noted that claim 1 contains an earlier recitation of the limitation "at least one catalyst". Thus, it is unclear whether applicant intends to recite the same catalyst or secondary/tertiary catalysts.

Claim Rejections - 35 USC § 102

11. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

12. Claims 1, 3-19 and 42-43 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Wu 6465052

The present application is to a method for fabricating a membrane wherein the disclosed inventive concept comprises the specific twin-wire arc depositing technique.

<u>As to claims 1 and 4:</u>

Wu disclose a method for production of nano-porous coatings (TITLE); particularly, a method for producing a nano-porous coating (*the coating is the catalyst deposited on the*

substrate) on a substrate (*the substrate serves as the membrane*) (COL 1, lines 5-10/ COL 3, lines 30-67). Wu discloses that his method is capable of producing metal compounds and ceramic materials in a thin film or coating form (COL 2, lines 56-60/ COL 3, lines 30-67). Specific metallic materials such as the metals of Group 2/IIA, 3-12, 13/IIIA or 14/IVA or 15/VA are mentioned (COL 8, lines 20-50). *Thus, any one of these metals materials constitutes a catalyst material.* Deposition is carried onto a solid substrate (COL 2, lines 65-67). *The surface on which the metals are deposited represents the eventual anode/cathode sides of the substrate (the membrane).* Wu makes clear that porous solids have been utilized in a wide range of applications including membranes, catalysts and electrodes (COL 1, lines 11-15).

Examiner's note: *the preamble recitation "for use in a fuel cell" is deemed to be calling for ultimate intended use of the fabricated membrane, as such, no patentable weight has been given to that recitation.*

As to claims 5, 8 and 15-18:

The method includes the steps of: a) operating a twin-wire arc nozzle to heat and at least partially vaporize two wires of a metal for providing a stream of nanometer sized vapor clusters of the metal into a chamber in which the substrate is disposed (ABSTRACT/CLAIM 1/COL 3, lines 30-67/COL 6, lines 10-60); b) injecting a stream of reactive gas into the chamber to impinge upon the stream of metal vapor clusters and exothermically react therewith to produce substantially nanometer-sized metal compound or ceramic clusters (ABSTRACT/ CLAIM 1/ COL 3, lines 30-67/COL 6, lines 10-60); c) operating heat treatment devices to heat treat the metal compound or ceramic clusters (ABSTRACT/ CLAIM 1/ COL 3, lines 30-67/COL 6, lines 10-60); d) directing the metal compound or ceramic clusters to impinge and deposit onto the

substrate for forming the nano-porous coating (ABSTRACT/ COL 3, lines 30-67/COL 6, lines 10-60).

As to claims 6 and 9-10:

Wu discloses reactive gases including oxygen, nitrogen, hydrogen, argon, helium and carbon, among others (COL 4, lines 24-37/Col 3, lines 7-25). Such a reactive gas is reacted with the metal clusters to form nanometer sized ceramic clusters (COL 4, lines 38-50/Col 3, lines 7-25).

As to claim 7:

The arc nozzles to promote efficient metal vaporization are disclosed (COL 7, lines 40-50 or lines 50-60 or lines 13-15). A second arc zone is disclosed (COL 8, lines 1-5).

As to claim 11:

A train of individual pieces of glass/plastic substrate is moved sequentially or concurrently into the coating chamber and then moved out of the chamber after the coating is formed (COL 9, lines 55-60).

As to claims 12-13:

Wu discloses oxide-based or ceramic materials (COL 9, lines 65-67) and/or plastic substrates (*polymeric materials*) (COL 6, lines 62-64).

As to claim 14:

The metal composition may include an alloy or mixture of at least two metallic elements (COL 9, lines 61-65/CLAIM 8).

As to claim 19:

Different metal materials (catalysts) are disclosed (COL 7, lines 60-67).

As to claims 42-43:

Conveying rollers 92a, 92b, 92c and 92d represent respective feeding and winding rollers to which a substrate material is first fed to a coating chamber 90 and thereafter taken up (FIGURE 1/ COL 1, lines 10-23/ Col 6, line 61 to COL 7, line 5). Substrate pieces 94a-uncoated, 94b-being coated and 94c-coated represent feeding segments of the membrane fed into a first side of the coating chamber 90, and thereafter being taken-up on another side of the coating chamber 90 (See FIGURE 1/ COL 1, lines 10-23/ Col 6, line 61 to COL 7, line 5).

Thus, the present claims are anticipated.

13. (*At least*) Claims 1 and 4 are rejected under 35 U.S.C. 102(e) as being anticipated by Smith et al 6924249.

As to claims 1 and 4:

Smith et al disclose a direct application of catalyst to substrate via a thermal spray process (TITLE). The process includes applying a catalytic metal to a substrate (*the substrate serves as the membrane*) utilizing said thermal spray process (ABSTRACT/COL 1, lines 45-50). Twin-wire arc deposition is one of the most common types of thermal spray (COL 2, lines 52-60). The catalytic metal forms a direct bond to the substrate and forms a catalytically active layer thereon capable of catalyzing the conversion of at least hydrocarbons (COL 1, lines 52-67). **EXAMPLE 4** carries out a twin-wire arc thermal spray deposition of a catalytic metal onto a substrate. *The surface on which the metals are deposited represents the eventual anode/cathode sides of the substrate (the membrane).*

Examiner's note: *the preamble recitation "for use in a fuel cell" is deemed to be calling for ultimate intended use of the fabricated membrane, as such, no patentable weight has been given to that recitation.*

Thus, Smith et al anticipate the present claims.

Claim Rejections - 35 USC § 103

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

15. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

16. Claims 1-4, 13, 19, 39-41 and 46-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Narayanan et al 6171721 in view of Smith et al 6924249.

As to claims 1 and 3-4:

Narayanan et al disclose a method for preparing a membrane for use in a fuel cell membrane electrode assembly including the steps of providing an electrolyte membrane, and

depositing a catalyst onto the electrolyte membrane; the deposited catalyst may be applied to multiple sides of the membrane (ABSTRACT). An electrolyte polymer is casted into a membrane, wherein the membrane has an eventual anode side and an eventual cathode side, and at least one catalyst is deposited onto at least one of the eventual anode/cathode sides of the electrolyte membrane (CLAIM 1).

As to claim 2:

The deposited catalyst results in a catalyst weight ranging from 0.05 mg/cm^2 to about 1.0 mg/cm^2 of said electrolyte membrane (CLAIM 4/COL 2, lines 10-18).

As to claim 13:

The electrolyte membrane is NAFION (COL 5, lines 33-37/ COL 7, lines 1-10/ EXAMPLE 1). *Note that nafion is an ion exchange polymer.*

As to claim 19:

The anode is being constructed to contain Pt-Ru alloy while the cathode is constructed to contain only Pt (COL 6, lines 55-65/CLAIM 20). *Thus, different catalysts are employed.*

As to claims 39-40:

Narayanan et al makes known that the inventive method forms a membrane electrode assembly comprising the steps of obtaining a catalyst, obtaining a backing and depositing said catalyst onto the backing (CLAIM 21/CLAIMS 59-61).

As to claim 41:

An electrolyte polymer is casted into a membrane, wherein the membrane has an eventual anode side and an eventual cathode side, and at least one catalyst is deposited onto at least one of the eventual anode/cathode sides of the electrolyte membrane (CLAIM 1).

As to claims 46-47:

The deposition method of Narayanan et al encompasses the step of providing (or feeding) the substrate to a deposition chamber to deposit the catalyst material and thereafter removing the substrate coated material from the chamber (COL 4, lines 26 to COL 5, line 22/ FIGURE 1).

Narayanan et al discloses a method for making a membrane including deposition. However, the preceding prior art reference fails to expressly disclose the specific twin-wire arc deposition.

Smith et al disclose a direct application of catalyst to substrate via a thermal spray process (TITLE). The process includes applying a catalytic metal to a substrate (*the substrate serves as the membrane*) utilizing said thermal spray process (ABSTRACT/COL 1, lines 45-50). Twin-wire arc deposition is one of the most common types of thermal spray (COL 2, lines 52-60). The catalytic metal forms a direct bond to the substrate and forms a catalytically active layer thereon capable of catalyzing the conversion of at least hydrocarbons (COL 1, lines 52-67). **EXAMPLE 4** carries out a twin-wire arc thermal spray deposition of a catalytic metal onto a substrate. *The surface on which the metals are deposited represents the eventual anode/cathode sides of the substrate (the membrane).*

(***Emphasis added→***) It is crucial to note that Smith et al's invention has the advantage of providing a method for application of catalytically active substances to a substrate that is simple, can be incorporated easily into existing production facilities, is a one-step process, and that can be utilized to apply catalytically active substances to a variety of substrates in addition to the heat exchangers disclosed therein (COL 1, lines 45-50). In particular, disclosed is that Smith et al's method can be utilized to apply the catalytic metals to any substrate capable of being sprayed by

thermal spray process, such substrates includes metals, alloys and ceramics. Thus, Smith et al's invention has utilization in preparing catalytically active surfaces in a variety of components not previously possible (COL 7, lines 7-22).

In view of the above, it would have been obvious to a person possessing a level of ordinary skill in the art at the time the invention was made to employ the specific twin-wire arc deposition of Smith et al to make the catalyst layer on the substrate of Narayanan et al as Smith et al disclose that their invention has the advantage of providing a method for application of catalytically active substances to a substrate that is simple, can be incorporated easily into existing production facilities, is a one-step process, and that can be utilized to apply catalytically active substances to a variety of substrates in addition to the heat exchangers disclosed therein (COL 1, lines 45-50). In particular, disclosed is that Smith et al's method can be utilized to apply the catalytic metals to any substrate capable of being sprayed by thermal spray process, such substrates includes metals, alloys and ceramics. Thus, Smith et al's invention has utilization in preparing catalytically active surfaces in a variety of components not previously possible (COL 7, lines 7-22). *Thus, Smith et al's disclosures provides specific guidance to employ their twin wire arc deposition of catalytic materials in a plethora of applications or fields including in the formation of membrane electrode assemblies for fuel cells.*

17. Claims 1-19, 39-43 and 46-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Narayanan et al 6171721 in view of Wu 6465052.

As to claims 1 and 3-4:

Narayanan et al disclose a method for preparing a membrane for use in a fuel cell membrane electrode assembly including the steps of providing an electrolyte membrane, and depositing a catalyst onto the electrolyte membrane; the deposited catalyst may be applied to multiple sides of the membrane (ABSTRACT). An electrolyte polymer is casted into a membrane, wherein the membrane has an eventual anode side and an eventual cathode side, and at least one catalyst is deposited onto at least one of the eventual anode/cathode sides of the electrolyte membrane (CLAIM 1).

As to claim 2:

The deposited catalyst results in a catalyst weight ranging from 0.05 mg/cm^2 to about 1.0 mg/cm^2 of said electrolyte membrane (CLAIM 4/COL 2, lines 10-18).

As to claim 13:

The electrolyte membrane is NAFION (COL 5, lines 33-37/ COL 7, lines 1-10/ EXAMPLE 1). *Note that nafion is an ion exchange polymer.*

As to claim 19:

The anode is being constructed to contain Pt-Ru alloy while the cathode is constructed to contain only Pt (COL 6, lines 55-65/CLAIM 20). *Thus, different catalysts are employed.*

As to claims 39-40:

Narayanan et al makes known that the inventive method forms a membrane electrode assembly comprising the steps of obtaining a catalyst, obtaining a backing and depositing said catalyst onto the backing (CLAIM 21/CLAIMS 59-61).

As to claim 41:

An electrolyte polymer is casted into a membrane, wherein the membrane has an eventual anode side and an eventual cathode side, and at least one catalyst is deposited onto at least one of the eventual anode/cathode sides of the electrolyte membrane (CLAIM 1).

As to claims 46-47:

The deposition method of Narayanan et al encompasses the step of providing (or feeding) the substrate to a deposition chamber to deposit the catalyst material and thereafter removing the substrate coated material from the chamber (COL 4, lines 26 to COL 5, line 22/ FIGURE 1).

Narayanan et al discloses a method for making a membrane including deposition. However, the preceding prior art reference fails to expressly disclose the specific twin-wire arc deposition and certain steps directly associated with the twin-wire arc deposition.

As to claims 1 and 4:

Wu disclose a method for production of nano-porous coatings (TITLE); particularly, a method for producing a nano-porous coating (*the coating is the catalyst deposited on the substrate*) on a substrate (*the substrate serves as the membrane*) (COL 1, lines 5-10/ COL 3, lines 30-67). Wu discloses that his method is capable of producing metal compounds and ceramic materials in a thin film or coating form (COL 2, lines 56-60/ COL 3, lines 30-67). Specific metallic materials such as the metals of Group 2/IIA, 3-12, 13/IIIA or 14/IVA or 15/VA are mentioned (COL 8, lines 20-50). *Thus, any one of these metals materials constitutes a catalyst material.* Deposition is carried onto a solid substrate (COL 2, lines 65-67). *The surface on which the metals are deposited represents the eventual anode/cathode sides of the substrate (the membrane).* Wu makes clear that porous solids have been utilized in a wide range of applications including membranes, catalysts and electrodes (COL 1, lines 11-15).

Examiner's note: *the preamble recitation "for use in a fuel cell" is deemed to be calling for ultimate intended use of the fabricated membrane, as such, no patentable weight has been given to that recitation.*

As to claims 5, 8 and 15-18:

The method includes the steps of: a) operating a twin-wire arc nozzle to heat and at least partially vaporize two wires of a metal for providing a stream of nanometer sized vapor clusters of the metal into a chamber in which the substrate is disposed (ABSTRACT/CLAIM 1/COL 3, lines 30-67/COL 6, lines 10-60); b) injecting a stream of reactive gas into the chamber to impinge upon the stream of metal vapor clusters and exothermically react therewith to produce substantially nanometer-sized metal compound or ceramic clusters (ABSTRACT/ CLAIM 1/ COL 3, lines 30-67/COL 6, lines 10-60); c) operating heat treatment devices to heat treat the metal compound or ceramic clusters (ABSTRACT/ CLAIM 1/ COL 3, lines 30-67/COL 6, lines 10-60); d) directing the metal compound or ceramic clusters to impinge and deposit onto the substrate for forming the nano-porous coating (ABSTRACT/ COL 3, lines 30-67/COL 6, lines 10-60).

As to claims 6 and 9-10:

Wu discloses reactive gases including oxygen, nitrogen, hydrogen, argon, helium and carbon, among others (COL 4, lines 24-37/Col 3, lines 7-25). Such a reactive gas is reacted with the metal clusters to form nanometer sized ceramic clusters (COL 4, lines 38-50/Col 3, lines 7-25).

As to claim 7:

The arc nozzles to promote efficient metal vaporization are disclosed (COL 7, lines 40-50 or lines 50-60 or lines 13-15). A second arc zone is disclosed (COL 8, lines 1-5).

As to claim 11:

A train of individual pieces of glass/plastic substrate is moved sequentially or concurrently into the coating chamber and then moved out of the chamber after the coating is formed (COL 9, lines 55-60).

As to claims 12-13:

Wu discloses oxide-based or ceramic materials (COL 9, lines 65-67) and/or plastic substrates (*polymeric materials*) (COL 6, lines 62-64).

As to claim 14:

The metal composition may include an alloy or mixture of at least two metallic elements (COL 9, lines 61-65/CLAIM 8).

As to claim 19:

Different metal materials (catalysts) are disclosed (COL 7, lines 60-67).

As to claims 42-43 and 46-47:

Conveying rollers 92a, 92b, 92c and 92d represent respective feeding and winding rollers to which a substrate material is first fed to a coating chamber 90 and thereafter taken up (FIGURE 1/ COL 1, lines 10-23/ Col 6, line 61 to COL 7, line 5). Substrate pieces 94a-uncoated, 94b-being coated and 94c-coated represent feeding segments of the membrane fed into a first side of the coating chamber 90, and thereafter being taken-up on another side of the coating chamber 90 (See FIGURE 1/ COL 1, lines 10-23/ Col 6, line 61 to COL 7, line 5).

In view of the above, it would have been obvious to a person possessing a level of ordinary skill in the art at the time the invention was made to employ the specific twin-wire arc deposition and certain steps directly associated with the twin-wire arc deposition of Wu to make the catalyst layer on the substrate of Narayanan et al as Wu summarizes his invention is advantageous because the twin wires can be fed into the arc cell at a high rate with their leading tips readily vaporized and this feature makes the method fast and effective and makes it possible to mass produce conductive coatings on a substrate cost-effectively; the system needed to carry out the twin-wire arc deposition is simple and easy to operate, and its the overall product cost is very low. Wu's inventive method also allows to readily convert a wide variety of metallic elements into nanometer scaled clusters for deposition onto substrates; no known prior art technique is so versatile in terms of readily producing so many different types of coatings on a substrate; the metal elements remain uniformly dispersed and are capable of reacting to form uniformly mixed coatings; no post-fabrication treatment is necessary. *Thus, Wu's disclosures provides specific guidance to employ their twin wire arc deposition of metallic materials in a plethora of applications or fields including in the formation of membrane electrode assemblies for fuel cells.*

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Raymond Alejandro whose telephone number is (571) 272-1282. The examiner can normally be reached on Monday-Thursday (8:00 am - 6:30 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Raymond Alejandro
Primary Examiner
Art Unit 1745